wwPDB X-ray Structure Validation Summary Report (i)

Sep 25, 2023 – 11:59 AM EDT

PDB ID	:	5VVJ
Title	:	Cas1-Cas2 bound to half-site intermediate
Authors	:	Wright, A.V.; Knott, G.J.; Doxzen, K.W.; Doudna, J.A.
Deposited on	:	2017-05-19
Resolution	:	3.89 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

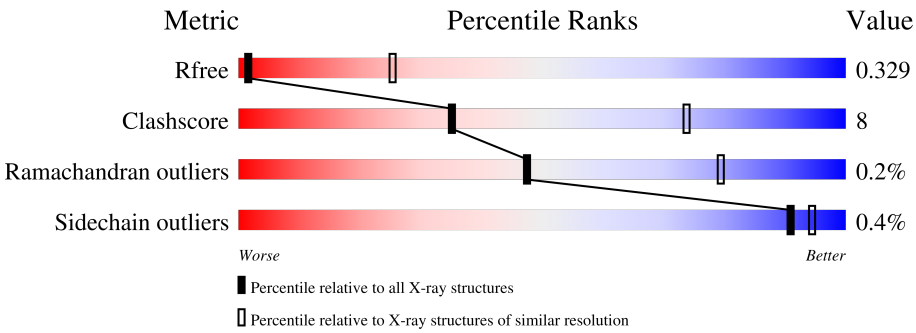
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.89 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1002 (4.14-3.66)
Clashscore	141614	1004 (4.12-3.68)
Ramachandran outliers	138981	1021 (4.14-3.66)
Sidechain outliers	138945	1014 (4.14-3.66)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Mol	Chain	Length	Quality of chain
1	A	305	68% 18% 14%
1	B	305	72% 16% 12%
1	C	305	71% 11% 17%
1	D	305	71% 15% 13%
2	E	95	75% 23% .
2	F	95	77% 23%
3	G	28	36% 64%

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Mol	Chain	Length	Quality of chain
4	H	112	40% 38% 22%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 11887 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called CRISPR-associated endonuclease Cas1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	262	2018	1290	358	363	7	0	0	0
1	B	269	2073	1328	369	369	7	0	0	0
1	C	253	1934	1238	340	349	7	0	0	0
1	D	265	2035	1303	363	362	7	0	0	0

- Molecule 2 is a protein called CRISPR-associated endoribonuclease Cas2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	93	731	470	127	131	3	0	0	0
2	F	95	743	477	129	133	4	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	95	GLY	-	expression tag	UNP P45956
F	95	GLY	-	expression tag	UNP P45956

- Molecule 3 is a DNA chain called DNA (28-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	G	28	578	275	118	158	27	0	0	0

- Molecule 4 is a DNA chain called DNA (112-MER).

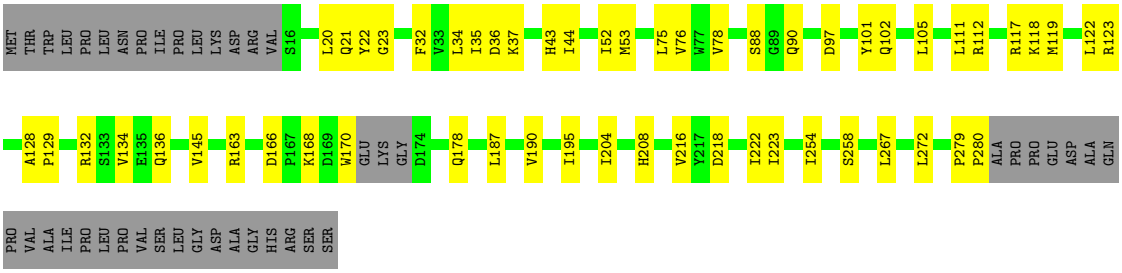
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	H	87	1775	845	313	531	86	0	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

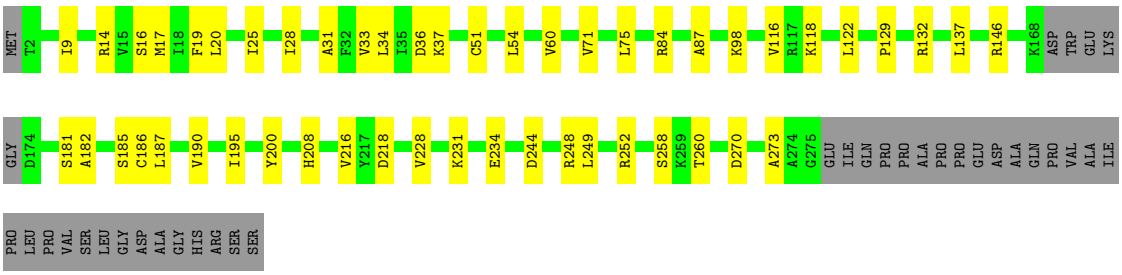
• Molecule 1: CRISPR-associated endonuclease Cas1

Chain A: 68% 18% 14%



• Molecule 1: CRISPR-associated endonuclease Cas1

Chain B: 72% 16% 12%

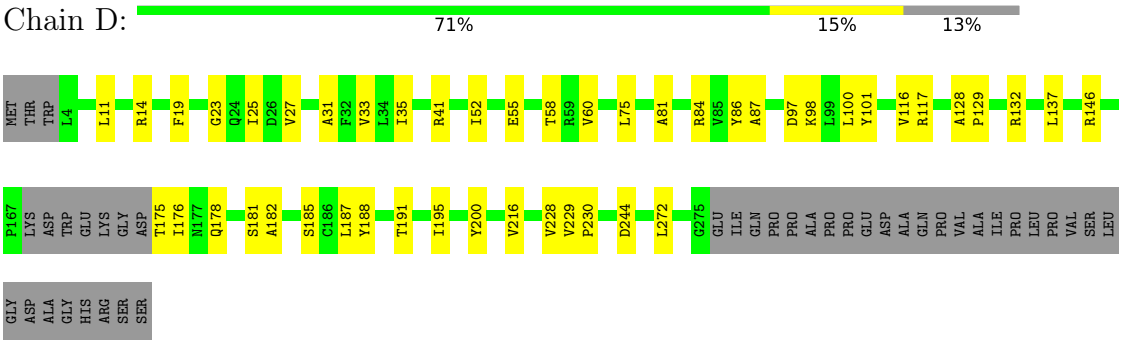


• Molecule 1: CRISPR-associated endonuclease Cas1

Chain C: 71% 11% 17%

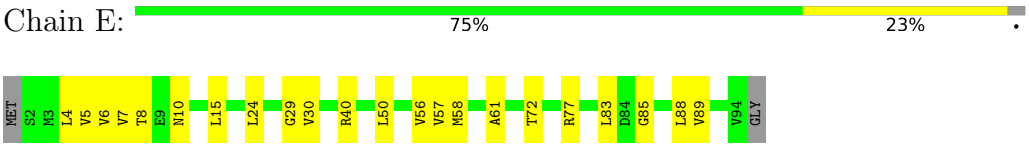
• Molecule 1: CRISPR-associated endonuclease Cas1

Chain D:



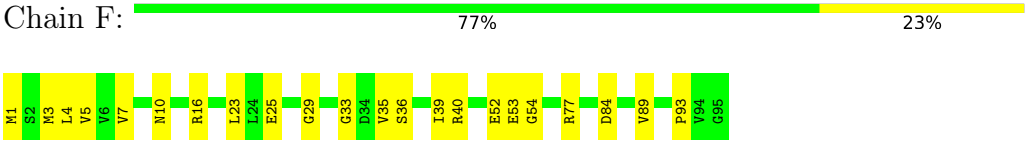
- Molecule 2: CRISPR-associated endoribonuclease Cas2

Chain E:



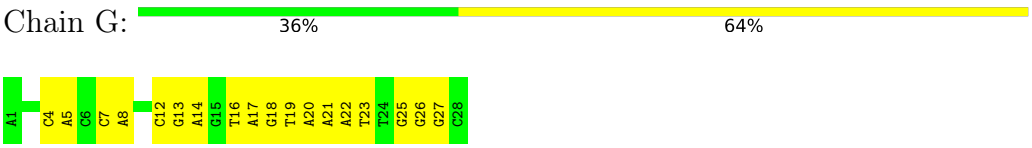
- Molecule 2: CRISPR-associated endoribonuclease Cas2

Chain F:



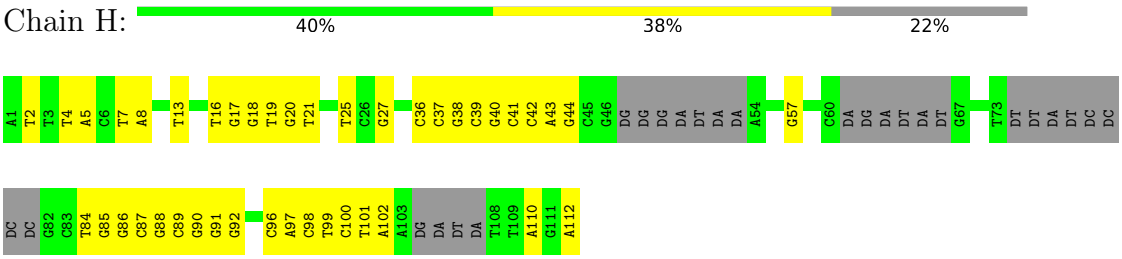
- Molecule 3: DNA (28-MER)

Chain G:



- Molecule 4: DNA (112-MER)

Chain H:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	75.07Å 183.11Å 196.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	134.10 – 3.89 134.10 – 3.28	Depositor EDS
% Data completeness (in resolution range)	99.8 (134.10-3.89) 96.2 (134.10-3.28)	Depositor EDS
R_{merge}	0.67	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.99 (at 3.26Å)	Xtriage
Refinement program	PHENIX 1.11.1	Depositor
R, R_{free}	0.288 , 0.329 0.288 , 0.329	Depositor DCC
R_{free} test set	2090 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å^2)	88.6	Xtriage
Anisotropy	0.487	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.26 , 67.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.36$, $< L^2 > = 0.19$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.89	EDS
Total number of atoms	11887	wwPDB-VP
Average B, all atoms (Å^2)	158.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.48% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| >5$	RMSZ	$\#\|Z\| >5$
1	A	0.26	0/2057	0.40	0/2789
1	B	0.26	0/2113	0.41	0/2866
1	C	0.26	0/1968	0.40	0/2666
1	D	0.26	0/2073	0.40	0/2811
2	E	0.26	0/745	0.44	0/1014
2	F	0.26	0/757	0.44	0/1029
3	G	0.56	0/652	0.83	0/1005
4	H	0.59	0/1982	0.95	0/3048
All	All	0.35	0/12347	0.57	0/17228

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2018	0	2069	35	0
1	B	2073	0	2143	35	1
1	C	1934	0	1989	25	1
1	D	2035	0	2109	29	1
2	E	731	0	744	15	0
2	F	743	0	759	16	0
3	G	578	0	314	20	0
4	H	1775	0	987	36	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	11887	0	11114	189	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 8.

The worst 5 of 189 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:59:ARG:NH1	4:H:2:DT:OP1	2.16	0.79
3:G:19:DT:H2'	3:G:20:DA:C8	2.20	0.76
1:C:59:ARG:HH12	4:H:2:DT:H5"	1.54	0.73
1:D:187:LEU:HD22	1:D:228:VAL:HG21	1.74	0.69
1:B:14:ARG:NH2	1:B:71:VAL:O	2.28	0.67

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:146:ARG:NH1	4:H:110:DA:OP1[1_655]	2.01	0.19
1:C:108:ASP:OD2	1:D:146:ARG:NH1[4_555]	2.04	0.16

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	258/305 (85%)	247 (96%)	11 (4%)	0	100	100
1	B	265/305 (87%)	251 (95%)	13 (5%)	1 (0%)	34	71
1	C	247/305 (81%)	243 (98%)	4 (2%)	0	100	100
1	D	261/305 (86%)	248 (95%)	13 (5%)	0	100	100
2	E	91/95 (96%)	87 (96%)	4 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	F	93/95 (98%)	91 (98%)	1 (1%)	1 (1%)	14	51
All	All	1215/1410 (86%)	1167 (96%)	46 (4%)	2 (0%)	47	79

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	16	SER
2	F	53	GLU

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	209/245 (85%)	208 (100%)	1 (0%)	88	93
1	B	216/245 (88%)	215 (100%)	1 (0%)	88	93
1	C	200/245 (82%)	199 (100%)	1 (0%)	88	93
1	D	212/245 (86%)	211 (100%)	1 (0%)	88	93
2	E	78/79 (99%)	78 (100%)	0	100	100
2	F	79/79 (100%)	79 (100%)	0	100	100
All	All	994/1138 (87%)	990 (100%)	4 (0%)	91	94

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	43	HIS
1	B	51	CYS
1	C	51	CYS
1	D	176	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

There are no ligands in this entry.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers (i)

Unable to reproduce the depositors R factor - this section is therefore empty.